INTERNATIONAL POLAR OBSERVATORIES

ON August 1, it is hoped, that a ring of observing stations will begin work all round the pole. By this time all the expeditions that have been arranged for will either be on the way or on the spot. The readers of NATURE are doubtless familiar with the inception and progress of a scheme for Polar research which originated in 1875 with the late Lieut. Weyprecht, and has been gradually built up until it has assumed the proportions of a great international effort to obtain accurate scientific observations on the physical and biological conditions of the polar area. Our Map of the Arctic Regions will enable the reader to note the localities of the various stations, and the nationality of the observing parties in each case. Meantime it may be useful to give a brief history of the scheme, and a sketch of the programme which it is proposed to carry out. This we are enabled to do from the official documents issued by the International Polar Commission.

As we have already said, it was in 1875, at the forty-eighth meeting of the Association of German Naturalists and Physicists at Gratz that Lieut. Carl Weyprecht explained his views as to the proper basis for Arctic explorations. He showed that while the Polar regions undoubtedly offer one of the most important fields of investigation for all branches of natural science, this is especially the case with reference to inquiries into the physical condition of the earth. The numerous and costly expeditions which have hitherto been organised have, however, yielded comparatively insignificant returns, so that it may almost be said that they have merely contributed to show more clearly how important it would be for all branches of natural knowledge to have those regions explored in a thoroughly scientific way. The scientific results of Polar voyages hitherto have been very scanty, and have borne no proportion to the expenditure of money and labour involved in the expeditions. Weyprecht ascribes this principally to the circumstance that in these Polar voyages geographical discovery was always made the chief object, while scientific investigations were considered to be of secondary importance. He points out also the isolated character of the individual voyages, and consequently of the scientific observations taken during their continuance. The observations are therefore deficient in a qualification which is of great importance in Polar regions, viz. the possibility of a comparison with simultaneous observations at a number of other places. Lieut. Weyprecht therefore proposed to deviate from the principles which have hitherto ruled Polar explorations, by abandoning geographical discovery and particularly reaching the Pole, as the main object, and instead aiming at scientific observations, especially those of a physical character. He proposed that, instead of isolated voyages in the Polar regions, expeditions should be sent out, organised on a common plan, in order to take simultaneous physical observations, for a considerable space of time, at several different points around the Pole.

In conjunction with Count Wilczek, Lieut. Weyprecht drew out a programme for Polar research of this type which was submitted to the International Meteorological Congress, held at Rome in the spring of 1879. The Congress, when this programme was submitted to it, recognised the great importance of Weyprecht's proposals, and recommended it for adoption to all governments. Owing, however, to the fact that all the individual delegates to the Congress had not received definite instructions from their respective governments to deliberate upon such a scheme and to make the necessary arrangements for its execution, the International Meteorological Committee, appointed by the Congress, was instructed to summon a special conference to discuss the subject at Hamburg on October 1 next ensuing.

This conference was attended by nine delegates from the following states:—Austria, Hungary, Denmark, France, Germany, the Netherlands, Norway, Russia, and Sweden. It commenced its operations by the preparation of a detailed programme for the enterprise, and fixed as an indispensable condition of its success, that at least eight points in the Arctic regions should be occupied, and that the interval from the autumn of 1881 to the autumn of 1882 should be the period for the proposed twelve months' observations. The International Polar Conference finally, in order to ensure that due attention should be paid to the necessary arrangement in the different countries, constituted itself as a permanent International Polar committee, with the right of electing new members, and chose Dr. Neumayer as its president.

The second International Polar Conference at Bern in August, 1880, was attended by eight delegates from the same states as before, and in addition by a delegate from Italy, and at its later meetings Prof. Wild, the president of the International Meteorological committee, was present as a member. It appeared from the reports of the delegates that at that time four states had definitely promised participation in the scheme, by occupying stations in the Arctic regions, viz. Austria (Count Wilczek), Denmark, Norway and Russia. The Conference decided to postpone the commencement of operations for a year, *i.e.* till the autumn of 1882, in order to facilitate the timely co-operation of other countries, and the consequent fulfilment of the condition of the occupation of eight stations, which had been fixed by the Hamburg meeting. At this Conference Dr. Neumayer resigned the presidency of the committee, and Prof. Wild was elected to fill the vacancy. This Conference also published its protocols and a condensed report of its proceedings. The President, in May, 1881, announced that the carrying out of the complete scheme, by a sufficient number of observers, was secured by promises of the establishment of at least eight stations in the Arctic regions, and he consequently invited them to the projected third International Polar Conference at St. Petersburg, August 1, 1881.

The third International Polar Conference at St. Petersburg was attended by ten delegates from the States of Austria, Denmark, France, the Netherlands, Norway, and Sweden, of which, however, France and the Netherlands had not yet announced their definite participation in the undertaking, while Russia and the United States had promised to occupy two stations apiece.

Accordingly the Conference finally fixed the epochs of commencement and termination of the simultaneous observations at all stations, and adopted a definite programme for all stations, in as close accordance as possible with the resolutions of the Hamburg Conference, in so far as this appeared necessary for the comparability of the observations.

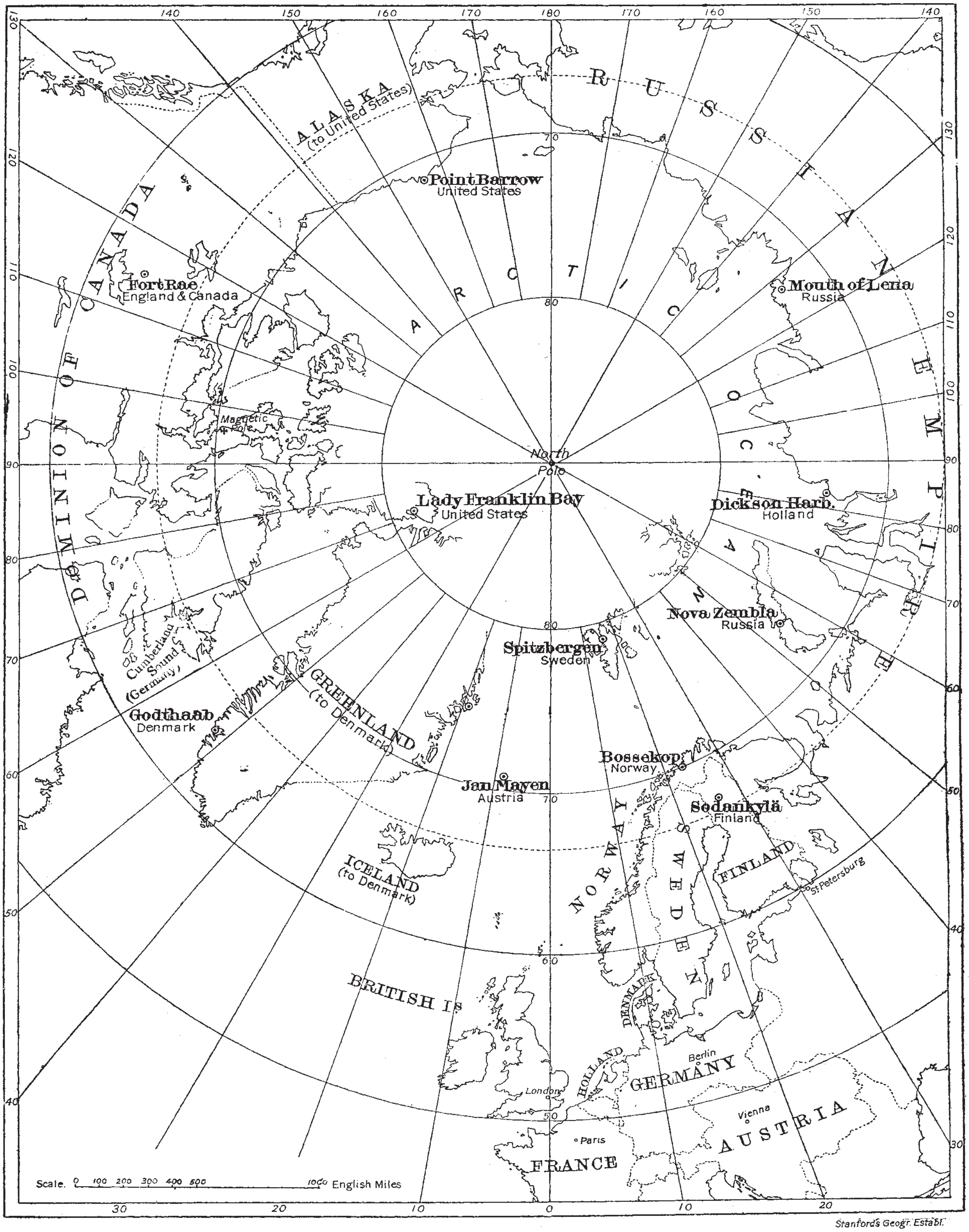
The Conference resolved to request the President and the other members to endeavour to secure that during the period of the Polar expeditions and their observations, the meteorological and magnetical observations in other zones, and the Royal and mercantile navies of each nation should be invited to furnish the data required for preliminary comparison, by more frequent observations, and particularly by observing the variations of magnetic instruments on the term days, and, moreover, that on these days and at times of magnetic disturbances the currents in the various telegraph lines should be specially and carefully studied.

The following is the programme which was adopted at the Conference at St. Petersburg for the observations to be made at the international Polar stations and for their first preliminary discussion:—

I. NECESSARY OBSERVATIONS

a. Beginning and Ending of the Observations

1. The international Polar stations are to begin their observations as soon as possible after August 1, 1882, and end them as late as possible before September 1, 1883.



Stanford's Geogr. Estabt.

b. Times of Observation

2. The hourly magnetical and meteorological observations may be made according to any time, only the magnetical observations on the term days must always be made according to Göttingen time (mean civil time). The term days are always the 1st and 15th of every month, except January, where the 2nd is to be taken as the term day instead of the 1st.

c. Order of the Observations

3. The expeditions are free to choose the order of their observations as they think fit.

d. Meteorological Observations

4. Air. Temperature. The mercurial thermometers should be read to 0°·1 C., the spirit thermometers to at least 0°·5 C.

5. The thermometers should be verified at the Central Meteorological Offices, and the spirit thermometers besides are to be compared with a mercurial thermometer at the place of observation at as low temperature as possible. The zero point of all thermometers used in the observations is to be determined afresh from time to time.

6. The thermometers are to be placed at a height of at least 1½ to 2 metres above the ground, in a screen like that given by Wild, and which will secure that without excessive interference with the free circulation of the air about them they will be sheltered from all disturbing influences of radiation.

7. The minimum thermometer for the determination of air temperature must be placed under the same conditions as the other thermometers.

8. The temperature of the sea on the surface and at the depth of every 10 metres is to be observed wherever possible. The following are suggested as useful instruments for this purpose:—sluggish thermometers by Eckmann, Negretti and Zambra, Miller-Casella, &c.

9. Pressure. Every station must at least have a standard mercurial barometer and a good observing mercurial-barometer, besides reserve barometers and aneroids.

10. The barometers must be verified by a Central Meteorological Office, and the observing barometer must be compared at least every week once with standard barometer.

11. Humidity. The psychrometer and the hair hygrometer are to be used, but at low temperatures they must be compared as often as possible with instruments for direct observation.

12. Wind. The vane and Robinson's anemometer should be arranged to be read off inside the observatory (*vide* the arrangement of the Swedish instruments at Spitzbergen). The direction of the wind is to be given for every 16 points and according to true bearings. Its velocity should always be given according to Robinson's anemometer, and also estimated Beaufort's scale. As a reserve instrument for measuring the wind force, in case of injury to Robinson's anemometer, Hagemann's anemometer recommended itself as being simple in management and very strong.

13. Clouds. Form, amount, and direction of motion at various heights, are to be observed to 16 points.

14. Rainfall, &c. Occurrence and duration of rain, snow *Graupel* (soft hail) are to be noted, and when possible the amount.

15. Weather. Thunderstorms, hail, fog, hoar-frost, and optical phenomena are also to be noted.

e. Observations of Terrestrial Magnetism

16. In determination of absolute declination and inclination the accuracy of one minute is to be aimed at, and in those of the absolute horizontal intensity accuracy of 0,001 of its value.

17. It is decidedly necessary, besides the absolute observations in the observatory itself, to make a series of measurements in its neighbourhood, in order to prove the existence of possible local influences.

18. The absolute observations must be conducted in the closest connection and synchronously with the readings of the variation instruments, so as to render it possible to reduce the indications of the latter to absolute value of determination, *e.g.* the absolute zero points of the different scales. The determinations must be made so frequently that any changes which may occur in the absolute value of the zero point of the scale of the variation apparatus may be detected with the requisite accuracy.

19. The observation of the variations should be extended to all three elements of terrestrial magnetism, and it is desirable that every station should have a complete duplicate system of variation instruments so as to make comparative observations from time to time, and to avoid the risk of the interruption of the observations by any accident.

20. The variation instruments should have small needles and the variation of horizontal intensity should be observed at least on one system with the unifilar apparatus with reflectors. Owing to the serious disturbances which may be expected, the scales of the variation instruments should be extended to at least 5° on each side, and as in certain cases deviations may even exceed these limits, the observers must be prepared to be able to measure even such greater excursions. The apparatus should be erected so as to facilitate as far as possible simultaneity of the observations.

21. During the whole time the variations should be read hourly. It is desirable that two readings should be made with an interval of a few minutes, for instance, before and after the exact hour.

22. As term days the first and fifteenth day of each month are fixed (only January 2 instead of 1 is taken); the days are from midnight to midnight, Göttingen time (mean civil time). The readings are to be made every five minutes, and always at the exact minute, and the three elements should be read as quickly as possible one after the other in the following order:—

Horizontal Intensity—Declination—Vertical Intensity.

23. On such term days during a whole hour, observations every twenty seconds are to be made, but only of the declination. These increased observations for one hour for the different term days are given in the following table:—

			Göttingen Civil Time.
1882,	August	1	12— 1 p.m.
		15	1— 2 ,,
	September	1	2— 3 ,,
		15	3— 4 ,,
	October	1	4— 5 ,,
		15	5— 6 ,,
	November	1	6— 7 ,,
		15	7— 8 ,,
	December	1	8— 9 ,,
		15	9—10 ,,
1883,	January	2	10—11 ,,
		15	11— Midn.
	February	1	12— 1 a.m.
		15	1— 2 ,,
	March	1	2— 3 ,,
		15	3— 4 ,,
	April	1	4— 5 ,,
		15	5— 6 ,,
	May	1	6— 7 ,,
		15	7— 8 ,,
	June	1	8— 9 ,,
		15	9—10 ,,
	July	1	10—11 ,,
		15	11— Noon.
	August	1	12— 1 p.m.
		15	1— 2 ,,

f. Auroral Observations

24. The auroras to be observed hourly with regard to shape, colour, and motion; the position to be given according to true bearings. The brilliancy of the different parts is to be estimated according to the scale 0—4 (vide Weyprecht: "Instructions for the Observation of Aurora, 1881"). In general, illumination of the aurora is sufficient to read printed matter; its brilliancy is to be estimated in this way and by the method employed in testing eyesight (as, for instance, according to the scale of Jaeger in Vienna).

25. On the term-days, continuous auroral observations will be carried out.

26. Especially remarkable instances of auroras and magnetic disturbances must be made the subject of special investigations, in order to render it possible to determine the connection of the variations of the phases of these two phenomena.

g. Astronomical Observations

27. As as much simultaneity as possible is a main object of the observations, determinations of position and time are to be carried out by instruments erected solidly (universal instrument, transit instrument, &c.), but these are not to exclude the use of good reflecting instruments. Every effort should be made as as quickly as possible to determine the longitude of the place with sufficient accuracy for the objects of expedition.

II. THE OPTIONAL OBSERVATIONS

28. The Conference recommends the following observations and inquiries to the notice of all gentlemen who have either to draw up instructions for an expedition, or themselves to take part in one.

29. Meteorology. The variation of temperature with height; the temperature of the soil, the snow, and the ice on the surface and at various depths; solar radiation; evaporation at all seasons. The melting of ice in the summer.

30. Terrestrtal magnetism. Occasional absolutely simultaneous readings of all three magnetical instruments, so as to determine accurately the relation between the simultaneous variations of horizontal and vertical intensity.

31. Galvanic earth currents. Observations of earth-currents in close connection with magnetic observations and those of auroral phenomena.

32. Hydrographical observations. Observations on currents, on the thickness, structure, and motion of ice, soundings and observations on the physical properties of sea-water, *e.g.* determinations of its temperature and specific gravity. Tidal observations if possible by means of automatic apparatus.

33. Aurora. Measurements of the height of the aurora by two observers stationed about 5 kilometres (3 miles) apart in the line of the magnetic meridian—spectroscopical observations.

34. Observations on atmospheric electricity; on astronomical and terrestrial refraction; on twilight; on the length of the second's pendulum; on the growth and structure of floating ice and of glaciers. The collection of samples of air for analysis.—Observations and collections in the departments of zoology, botany, geology, &c.

III. THE REDUCTIONS AND CALCULATIONS AT THE PLACE OF OBSERVATION

35. The rules adopted by the Congresses of Vienna and Rome are to be followed in all calculations and reductions of meteorological observations.

36. As regards the discussions of magnetic observations the adoption of the metrical units of Gauss is recommended. From the variation observations, the declination, and the horizontal and vertical components of the intensity are to be deduced.

IV.—PUBLICATION OF THE OBSERVATIONS

37. Summaries of the observations are to be sent to the International Polar Commission, as soon as possible after the return of the expedition, so as to be published speedily and in a uniform manner. It is desirable, if possible, to send even earlier notices of the fate and general progress of the expedition.

38. All observations are to be published *in extenso* when their discussion is complete. The International Polar Commission will therefore be reassembled for a fresh Conference, to learn the amount of information which has been obtained, and to come to an agreement as to the best mode of its publication.

39. In this publication the Metric scale will be used, and all temperatures expressed on the centigrade scale.

Nothing could be more complete and satisfactory than this programme, and from the results when reduced and carefully compared, valuable data may be expected as to the physics of the Arctic regions. We trust nothing will occur to mar the success and continuity of the observations, and that they will be such as to encourage their continuance, for we fear that a single year's observations cannot be regarded as furnishing anything like sufficient data to warrant perfectly trustworthy conclusions. The Commission very wisely decided that it would be advisable to obtain series of observations at existing observatories outside the Arctic Area, but as far as possible in the northern hemisphere. To their Circular on this subject they have received favourable answers from the following astronomical and meteorological observatories:—Pola, Munich, Utrecht, Moncalieri, Helsingfors, Breslau, Cordoba (South America), Potsdam, Naples, Lisbon, and Stonyhurst.

At the last moment, the English Government, although they sent no delegate to the Congresses, have decided, we are glad to say, to take a share in the great international undertaking. The following then is a list of the stations, beginning at Behring Strait, and coming eastwards, with the countries whose parties are to occupy them:—

Point Barrow, N.W. Coast Alaska. 71° 18′ N., 156° 24′ W. United States.
Fort Rae, Great Slave Lake. 62° 30′ N., 115° 40′ W. England and Canada.
Cumberland Sound, Davis Strait. 66° 30′ N., 66° W. Germany.
Lady Franklin Bay, N.E. Coast Grinnell Land. 81° 20′ N., 64° 58′ W. United States.
Godthaab, W. Coast of Greenland. 64° 10′ N., 51° 45′. Denmark.
Jan Mayen Island, between Greenland and Norway. 70° 58′ N., 8° 35′ W. Austria.
Spitzbergen. 79° 53′ N., 16° E. Sweden.
Bossekop, N. Coast Norway. 69° 56′ N., 23° E. Norway.
Sodankylâ, N. Finland. 67° 24′ N., 26° 36′ E. Finland.
Novaya Zemlya, Karmakulé Bay. 72° 30′ N., 53° E. Russia.
Dickson's Harbour, Mouth of Jenissei. 73° 30′ N., 82° E. Holland.
Mouth of Lena. 73° N., 124° 40′ E. Russia.

Besides these France will carry on observations at Cape Horn, and Germany at South Georgia, on the borders of the Antarctic area; while, on behalf of Italy, Lieut. Bové is co-operating in the Italian Antarctic Expedition.

THE LAY OF THE LAST VORTEX-ATOM

(*Vide* "THE UNSEEN UNIVERSE")

Melody—*Lorelei*

THE Vortex-Atom was dying
  The last of his shivering race—
With lessening energy flying
  Through the vanishing realms of Space.

No more could he measure his fleeting—
  No milestones to mark out his way;
But he knew by his evident heating
  His motion was prone to decay.

So he stayed in his drift rectilinear
  For Time had nigh ceased to exist,
And his motion grew ever less spinnier
  Till he scattered in infinite mist.

But as his last knot was dissolving
  Into the absolute nought—
"No more," so sighed he resolving,
  "Shall I as atom be caught.

"I've capered and whirled for ages,
  "I've danced to the music of spheres,
"I've puzzled the brains of the sages—
  "Whose lives were but reckoned by years.

"They thought that my days were unending,
  "But sadly mistaken were they;
"For, alas! my 'life-force' is expending
  "In asymptotic decay!"

Edinburgh University K.

OUR HEALTH RESORTS[1]

The Scottish Highlands

THE Highlands of Scotland have been rapidly rising in importance during recent years, as affording during the summer and autumn months the most desirable health resorts to professional and business men, as well as to invalids: the most varied scenery, unique as it is picturesque, to the tourist; and the most attractive pleasure-grounds to the sportsman. When it is considered how comparatively unknown to the general run of summer tourists and visitors are the climatic and scenic attractions of large portions of the Highlands, and how

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[1] See vol. xxv. p. 155.